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"Oft too some wretch, before our startled sight,
Struck as with lightning, by some keen disease
Drops sudden;—by the dread attack o'erpowered
He foams, he groans, he trembles, and he faints;
Now rigid, now convulsed, his laboring lungs
Heave quick, and quivers each exhausted limb,
Spread through the frame, so deep the dire disease
Perturbs his spirit; as the briny main
Foams through each wave beneath the tempest's ire.

But when, at length, the morbid cause declines,
And the fermenting humors from the heart
Flow back—with staggering foot the man first treads,
Led gradual on to intellect and strength."

LUCRETIUS, 95 B. C.

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CORRELATION OF NEUROLOGICAL FINDINGS, PSYCHOLOGICAL ANALYSES, AND SPEECH DISORDERS AMONG INSTITUTIONALIZED EPILEPTICS[1]

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PREFACE

Speech, one of the latest emergences of specificity of man, develops very early in life from vegetative and viable functions and continues to develop from higher and associational functions. This concept was learned early in my association with Professors C. L. Meader, and J. H. Muyskens of the Speech Department of the University of Michigan. A study of normal speech and speech that deviated from the normal brought forth the realization that the field of speech pathology was a bit of neglected medicine and psychology. To understand better the functioning of man's structure I took parallel cognate courses in the Medical School and in the Graduate Department of Psychology. It was Professor Shepard of the Psychology Department who wisely suggested that my field of specialization would best be served under an inter-departmental degree.

Man and his behavior are much too integrated and complex to be torn apart by individuals in separate departments of specialization. The bibliography is full of work which states that man is an integrated whole and that when his pathology is treated, the integrated picture must always be considered. Yet for any given abnormality we have several schools of thought in therapy, each one insisting that it is the best one. As an example we have only to consider the subject of stuttering. The late Dr. Eugene Hahn of Wayne University, wrote a book[2] giving a synopsis of the various schools of

1. A condensation of a dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the University of Michigan.

2. E. F. Hahn, Stuttering, *Significant Theories and Therapies, Stanford University Press, 1943.*

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thought in treating stuttering. The fact that each contributor and his method claimed success is good evidence that each method is necessary for a particular type of stuttering depending on the etiology. The fallacy lies in the fact that each contributor uses only the one approach advocated by his school of thought to treat every stutterer who comes to him. It becomes important to find the etiology of stuttering or of any other abnormality and to treat it and not the concomitant or resulting factors. For this reason a special attempt was made throughout this study to investigate the disorders of speech and behavior patterns from an etiological point of view. As the research progressed it became very evident that not only was the etiology important but that it was the time of occurrence of the various etiological factors that was so important in determining the manifestation of the abnormality.

Sincere appreciation is due the University of Michigan for the opportunity of carrying out this research as a student at the Horace H. Rackham School of Graduate Studies. To my doctoral committee[3] goes my gratitude for their efforts in directing my course of study and delimiting my problem and dissertation.

G. W. G.

THE NATURE OF THE STUDY

The nature of the study, conducted at the Caro State Hospital for Epileptics, Caro, Michigan, was a correlative one between neurological findings (clinical, pneumoencephalographic, and post mortem), psychological measurements, and speech deviations among institutionalized epileptics.

For definitions of a speech deviant, previous workers have offered various opinions ranging from a "person with a speech impediment" to a "person whose speech does not sound pleasing to the listener". Generally it is accepted that defective speech is "that type that is unintelligible or confusing, labored in production, too rapid or too slow, or when it is unpleasant in quality or in pitch". While these definitions serve as descriptions of speech defects, it is the purpose of the writer to explain these descriptions on an etiological

3. Doctoral Committee: Dr. J. F. Shepard, *Chairman*, Psychology; Dr. M. G. Colby, Psychology; Dr. E. C. Crosby, Neuro-Anatomy; Dr. D. G. Marquis, Psychology; Dr. J. H. Muyskens, Speech; Dr. L. H. Strong, Anatomy.

basis. On these terms I offer the definition that a speech deviant is a person *who presents an underlying abnormal condition the symptoms of which manifest themselves in the speech process.* Thus, instead of saying that an individual has a defect in articulation, phonation, rhythm, or symbolization, it becomes important for the sake of prevention therapeutics to say that the particular speech defect which the individual presents is symptomatic of deafness, cerebral thrombosis, hemorrhage. or embolism, glandular dysfunction, physical-chemical unbalance, malnutrition, developmental defects, or symptomatic of any physiological or psychological dysfunction.

It is needless to enumerate here the many serious and debilitating consequences that speech limitations may have on an individual socially, psychologically, and economically. Even more far-reaching, the etiology of that speech defect will usually manifest itself in other symptoms that also will have drastic effects on the individual. It thus becomes important in any study of the speech process to give careful attention to the factors of etiology.

PROBLEM

The study at the Caro State Hospital was outlined in two parts. The first was for statistical purposes and was made up of a general description of the various types of speech defects. The second division of the work, curtailed in its extent by the war, was planned with a view toward correlating all available data with the speech examinations.

In the early part of the research each patient was given a screening test. If a speech defect was noticed, the individual was immediately placed in the speech defective group without any attempt at a description or diagnosis of that speech defect. If no speech defect was apparent, a longer routine speech examination was given in order to be certain that there was no demonstrable defect in speech. In this manner, screening tests were given to all available patients. There was a total of 1252 patients examined. At this time statistics showed that of this group only 297 had speech that could be considered within normal limits. There were 205 individuals who did not have speech at the examination. These were rechecked to rule

out any possibility of a negativistic attitude toward the examiner or examination. It was verified that all of these patients either had never developed speech or had speech at one time which later deteriorated until all speech was lost. The remaining 750 patients had speech defects of varying types and degrees. To summarize, there was a total of 955 speech defectives, including those with no speech. Thus, 76.3 percent of the examined 1252 patients had speech defects. This is a very striking percentage in view of the fact that approximately 10 percent of the general population had speech defects in 1941.

After the patients with normal speech were screened from those who had defective speech, a detailed study was made of the "type" of speech presented by each individual in the speech defective group. Including in the "type" of speech was the melody, rhythm, accent, vowels and consonants, speech content, and various concomitant sensorimotor processes. There was no selection in the study of any special type of patient, sex, age, or I. Q. group. Examinations were given at the cottages in familiar environments. All speech examinations were made and described before any other information, such as medical, psychological, or sociological, was studied. The writer's efforts to complete as much of the study as possible before entrance into the U. S. Navy curtailed the number of speech examinations, and not all of the 955 speech defectives could be reexamined. No group in particular was omitted, but after an appreciable number of patients had been reexamined, the speech examinations were discontinued in order to allow for study of the history records. Speech examinations totaled 610 and included both sexes; the age group ranged from 18 months to 70 years, and the I. Q.'s from 1 to 141. It was felt that this sampling was a fair one and that it was indicative of the general types of patients at the institution.

It was not the purpose of this study to look for data to support a preconceived conclusion. Such a procedure would have greatly influenced the interpretation of the data. In order to have the speech examinations independent of other data and examinations, all speech examinations were made first. When over 600 cases were examined, diagnosed, described, and recorded, a careful study was made of the available medical, sociological, and psychological data. It was felt

that this sort of procedure would allow for an honest, correlative study between speech development and the medical and other findings.

These findings were presented in the form of charts and included the following information: sex and number reference of patient, date of birth, hereditary factors, condition of mother during gestation, factors at birth, childhood and later history, pneumoencephalographic reports, physical and neurological findings, I. Q., medical diagnosis, problems of behavior, mental deterioration, type of feeding, laterality, stammering or stuttering, plateau speech, age at onset of seizures, age of onset of speech, type of speech, and autopsy findings.

Time allowed for a study of case histories of 469 patients. Of these, 32 had normal speech, 329 defective speech, and 108 had either never developed speech, or had lost speech through deterioration.

Table I will give the reader a view of the general statistics of the patientes examined, while Table II shows the descriptive types of speech defects and disorders and their distribution.

TABLE I

	Number of Patients With Normal Speech	Number of Patients With Defective Speech	Total
Screening Examination	297	955	1252
Reexamined	297	610	907
Cases Correlated With Medical Histories	32	437	469

In order to arrive at some conclusions the patients were grouped according to their speech development. These groupings suggested three main categories of speech emergence: (1) speech not developed, (2) speech fractionally developed, and, (3) impaired speech. It is evident that there would be overlapping of thse types.

TABLE II

DISTRIBUTION OF SPEECH DISORDERS AND DEFECTS AMONG 610 SPEECH DEFECTIVE PATIENTS

No Speech	205
Dyslalia	203
Dysrhythmia	132
Dysarthria	103
Phonesthenia	47
Stuttering or stammering	47
Rhinolalia	44
Plateau	40
Foreign Accent	39
Hoarseness	21
Indistinct Speech	18
Hyphoid	16
Incoherent or Confused	16
Changes in Pitch	10
Idioglossia	7
Aphasia	7
Festination of Speech	6
Repetitive (not stuttering)	6
Thick Speech Due to Saliva	5
Irregular Rhythm	5
Senile Phonesthenia	4
Speech of Deaf	4
High Pitched Males	4
Alexia and Agraphia	3
High Pitched Females	2
Cleft Palate	2
Neoglistic Speech	1
Spastic Idioglossia	1

Note: There were, of course, patients who had more than one disorder or defect of speech.

DISCUSSION

From the many case histories of individuals with speech disorders confirmation was found for the previous tentatively applied time pattern scheme to explain the many disorders of speech on an etiological basis. From the temporal occurrence of these etiologies we may arrive at 3 major classifications of speech disorders. These did not include functional defects of speech such as imitation of poor speech models at home, foreign accent, and functional lisping. Although such defects of speech do exist they are not disorders of speech.

The first type of speech disorders included the group that had never developed speech. For the etiology of this type of disorder we may look for gestational maternal disturbances (toxic, glandular, infectious, traumatic), birth injuries, early post-natal difficulties (severe cyanosis, delayed breathing, indigestion, poor feeding habits, and rickets), deafness (congenital or early acquired), brain malformations, and severe infectious diseases. The incidence of poor genetic backgrounds was also very high in this group.

The second type showed a fractional emergence of the speech process. In this group we found individuals who do not acquire full normal development of the speech process. The pathology is usually concerned with the articulation of consonants, either through (1) developmental defects such as cleft palates, malocclusions, high narrow palates, (2) birth or cerebral injuries with paralytic sequelae including cerebellar, spastic, or athetotic speech, (3) hearing impairments from otitis media, trauma, or infectious diseases, (4) early poor feeding habits, malnutrition, and rickets.

The third type of speech disorder included the group of individuals who may have developed speech normally but whose speech later becomes impaired. That is, they have not had disturbances severe enough and early enough to interrupt the speech process in its formative period. Their speech becomes affected after some exogenous factor, (trauma, encephalitis, or any other neuropathological disturbance) or endogenous factor, (nutritional, metabolic, or glandular) sets in. The speech may become slow, hesitant, repetitive, lifeless, extremely rapid, explosive, plateau, or one of many other descriptive types. The impairment is usually generalized. The conson-

ants may not be lost and may be articulated in isolation but when they are used as speech, they are not controlled or coordinated. The finesse of articulation (with no reference to elocutionary articulation) controlled by selective movements of antagonistic muscles is lost and replaced by spastic activity of these antagonists which results in a dysrhythmia. Also included in this group were those who may have had either a fractional emergence of speech or an extremely delayed development of speech which later became impaired.

EPILEPTIC SPEECH

Some workers have written in the literature that one definite characteristic or symptom of the epileptic was his speech, "the epileptic voice" or "plateau speech". Scripture and Clark (74) have described the "voice sign" in epilepsy and claimed to have found it in 75 percent of their cases. If this statement were true, it would be of extreme clinical and diagnostic importance. It might be said then that an individual presenting such a speech pattern could be diagnosed as epileptic or at least be suspected of being epileptic pending other diagnostic symptoms. It might also be very significant in the etiology of epilepsy or in the attempt to single out a common epileptic pathology.

Although there are voluminous studies on epilepsy, as yet, none have explained its cause. Theories vary from Temple Fay's (24) view that the epileptic seizure is a "normal mass reaction of defense against cerebral anoxia" to Dr. Lennox's (49) view of "the existence of a cerebral dysrhythmia demonstrable by the electroencephalogram". Still none of these, in their attempt to explain what the convulsion is, have explained what the cause of the underlying disturbance is. It was our hope that a study of the speech that was supposed to be common in epilepsy would help in the understanding of the etiology of epilepsy. It is known that the speech pattern is important as one of the symptoms in the diagnosis of many diseases of the Central Nervous System, such as scanning speech in multiple sclerosis, slurring speech in paresis, and explosive speech in cerebellar lesions. It would be of extreme importance to be able to find a speech pattern closely diagnostic of epilepsy.

If after a careful study of the population at the institution, the epileptic speech pattern could be established then the interpretation of that speech pattern, with special reference to its etiology, would go a long way in identifying this pattern with the etiology of epilepsy. If it could be demonstrated that a certain "something" (trauma, encephalitis, agenesis, etc.) was the etiological factor in producing epilepsy and also introducing a certain type of speech pattern, then a study of that speech pattern might explain the etiology of the epilepsy.

Data from the Caro State Hospital for Epileptics, however, do not substantiate the statement that there is a typical epileptic speech. In view of this finding it would not be reliable to make a diagnosis of epilepsy on the basis of the typical epileptic speech pattern. It is further our judgement that whatever speech abnormality there is in an epileptic, it is not caused by the epilepsy but that certain disorders of speech accompanying epilepsy have as their underlying etiology the same factor that is causing the epilepsy.

CONTRIBUTIONS

After the completion of this study the following contributions are presented for consideration:

1. The various types of epileptics and their manifestations as described in the literature are also in evidence at the Caro State Hospital.
2. This is the first extensive study of speech disorders of institutionalized epileptics. Of a total of 1252 patients examined, 76.3 percent were found to have defective speech.
3. There is no speech typical of epileptics.
   a. The special type of speech usually referred to as the "typical epileptic speech" or "plateau speech" was found in only 4.41 percent of the patients whose speech was examined and described.
   b. In 11 patients who had no speech at the examination, reports were later found in their case histories that when speech was present it was of the "plateau type". This fact might suggest that plateau speech is one of the final stages in the deteriorating process before speech is entirely lost and that the deterioration is gradual rather than sudden as is often found in aphasic patients.

4. All speech disorders common in the general population are found in the epileptics. The disorders of speech found in the epileptics are not caused by the epilepsy *per se*, but are another element in the syndrome for which there is no known common etiology.

5. Too little evidence lies behind the "epileptic personality" concept to warrant its continuation as a diagnostic sign. Egotism, seclusiveness, paranoia ,schizophrenia, hypochondria, and other tendencies attributed to epileptics are also found among non-epileptics. It is to be recalled that some of the groups of epileptics at the Caro State Hospital are so far deteriorated that custodial care must be emphasized, since they cannot be redistributed among the communities. Even for this group of epileptics the so-called "epileptic personality" is not pathognomonic. Since no common syndrome based on a common etiology for epilepsy has been found, it is to be expected that there will be no common epileptic personality.

6. There is a definite correlation between cerebral malformation and the failure to develop speech. This malformation may be either generalized of specific but Broca's Area does not have to be involved in the failure of speech development nor does it have to be involved in cases where speech is lost. Consequently, loss of speech should not be used as a definite diagnostic aid and symptom in the localization of brain pathology. More positively it adds verifying strength to the concept that speech recruits from many gradients of nerves, muscles, and glands for the emergence of that specific adjustment.

7. Cyto-architecural malformations observed from the post-mortem histological examinations of brains give evidence that we must look farther back than birth for some causes of mental deficiency. When we have no positive indication of a birth or early post-natal disturbance in an exogenous child, we must consider the possibility of a gestational disturbance.

8. An attempt has been made to reclassify speech disorders from a descriptive basis to an etiological basis with special reference to the time relations of the etiology.

9. A disorder of speech is not a separate entity but is symptomatic of an underlying condition which is abnormal.

10. It there is some disturbance early in the life of the child, its damaging effect will depend upon the severity and temporal occurance of the agitator and upon the resistive threshold of the individual.

11. Test phrases such as "Methodist Episcopal, truly rural, third cavalry brigade, and artillery" should not be continued in neurological examinations as symptomatic of paresis. During the course of this study, some mentally deficient individuals and those with agenetic brains gave test phrase responses similar to that which is expected from paretics.

12. Encephalograms and post-mortem verifications suggest the importance of the pneumoencephalogram as an aid to diagnosis and determination of prognosis.

The doctoral dissertation, from which this article has been abstracted, is a most extensive one and the condensation, of necessity, must be brief. Therefore, to enhance the value of this brief discussion and to demonstrate its scope, the complete table of contents and bibliography have been included.

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AIMS OF THE TRAINING SCHOOL

The primary interest of The Training School is the mentally retarded and mentally defective child. Its aims are: to place him in a kindly, understanding environment; to help him to learn those things which will aid and comfort him in later life and make him a useful contributing member of his group and, as much as possible, of society in general; to give comfort and guidance to parents; to study him constantly to add to the increasing knowledge which becomes of assistance to all mentally handicapped.

—From our descriptive literature.

PROFESSIONAL PROGRAM

The research program which is visualized for Vineland is based on the simple premise that mental deficiency is due to either malformation or malfunctioning of a part of the nerve complex involved in mental or physical activity. In order to do research in any field, it is first necessary to identify the problem. The program thus falls logically into two phases, which may be simultaneous to a certain extent.

1. The securing of staff competent to investigate the physical (malformation) and mental (malfunctioning) causes of the defects known as mental deficiency. This would require, obviously, such specialists as psychologists; speech pathologists; biochemists; medical doctors, including psychiatrists and neurologists; etc. A diagnostic group would thus result, capable of diagnosing the causes of the condition to the extent to which existing knowledge permits, and, by persistent study of individual cases, of extending the field in which diagnosis would be possible.

2. The second step, in each case in which diagnosis is possible, would be a study of methods of remedying the situation by educational, psychological, medical, chemical, or surgical means. This would be a long range and continuing program, not likely to be completed in the life time of the Board or school officers. But from the time the research group was first established, the Training School would have available three things not now accessible to the parents of the mental deficients:

> A Diagnostic Center, capable of answering to the limit to which existing knowledge permits, the question, "What is the matter with the child?"
>
> A Treatment Center, capable within the same limits, of answering the second question, "What can be done about it?"
>
> A Research Center which is steadily extending the limits within which both these questions can be answered.

. . . . *adopted by The Board of Trustees, The Training School at Vineland, New Jersey.*

March 8, 1950